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ABSTRACT

Development of a standardized curriculum and customized test for mathematics is described. Because of the diversity of the New York City school system, a centrally-planned curriculum became a necessity for continuity and quality. The present mathematics curriculum has been in existence since 1982, and is both comprehensive and cyclical. Five strands in mathematics are mandated statewide: (1) numbers and numeration; (2) operations with whole numbers; (3) operations with fractions; (4) probability and statistics; and (5) geometry and measurement. Performance-based objectives are stated in behavioral terms for students at each grade level. A standardized test customized to the curriculum was developed from the shelf form of the Metropolitan Achievement Test, and was first given in 1986. A revised version was developed in 1987. Staff development programs familiarized teachers with the test and its implications for classroom instruction. These workshops, in 1987 and 1988, reminded teachers that they must follow the New York City curriculum for their students to do well. (SLD)

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Norm Referenced Test Customization - Curricular Considerations

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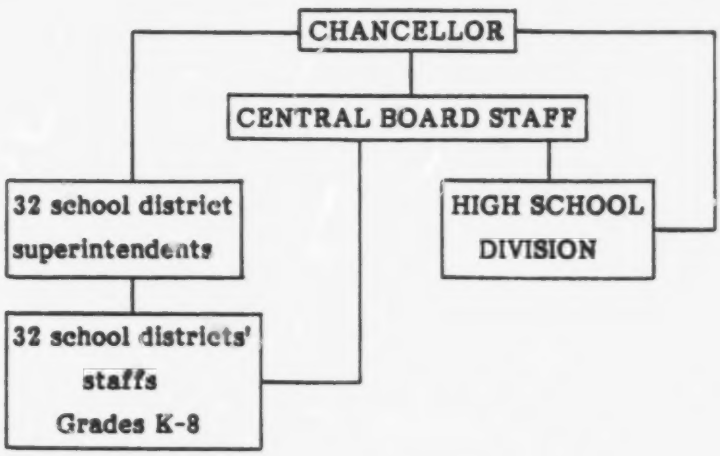
In order to understand the necessity for a customized test in the New York City School System, one must first attempt to understand the system's organization. The New York City School System consists of a chancellor who presides over the entire system, a centralized staff which services the entire school system, and 32 decentralized school districts, each headed by a district superintendent. Each district, in turn, has a staff that services the schools in that particular district. The following chart shows the general make-up of the New York City School System.



In grades 5 through 8 alone there are more than a half million students and more than 25,000 teachers. Due to the decentralized nature of the school system, the approach to curriculum within a given subject area varied from district to district and sometimes from school to school. In other words, there was no set curriculum in the school system for a given subject area. In some schools, teachers were not sure what they should be teaching so they taught the things they liked best within each subject area. This proved to be a problem for many students who often moved to different areas of the city during their school years and consequently encountered a very different curriculum within each school they attended. There was a lack of continuity in the educational process for this large population of children. In addition, the lack of a centrally planned curriculum contributed to a poor quality of education in many areas of the city, resulting in low achievement scores and a high drop-out rate.

It was important, therefore, to provide a planned curriculum for each subject area at every grade level throughout the school system. The present New York City mathematics curriculum, which was prepared by the New York City Central Board of Education's mathematics curriculum staff, has been in existence since 1982. Revisions have been made at each grade level during the past five years based on feedback from teachers and administrators who are using the curriculum. The curriculum is both comprehensive and cyclical in nature. The basic philosophy of the curriculum is that mathematics should be used as a vehicle to help students become good thinkers and to use these reasoning skills toward becoming productive individuals. The comprehensive nature of the curriculum is based on the premise that mathematics should provide something for everyone. Mathematics should not be viewed as something to fear but rather as a conglomerate of activities that can be enjoyable as well as thought provoking. The entire curriculum is based on general guidelines that are mandated by the Department of Education of the State of New York as essential in the area of mathematics. The New York State curriculum describes five strands in mathematics and provides general information about the concepts that must be covered within each strand. The New York City curriculum has further developed these strands into fourteen topics. The following table illustrates this information:

NEW YORK STATE MATHEMATICS CURRICULUM	NEW YORK CITY MATHEMATICS CURRICULUM
STRANDS	**TOPICS**
Number and Numeration	.01 Numbers and Numeration
Operations with Whole Numbers	.02 Addition of Whole Numbers
Operations with Fractions	.03 Subtraction of Whole Numbers
Probability and Statistics	.04 Multiplication of Whole Numbers
Geometry and Measurement	.05 Division of Whole Numbers
	.06 Fractions
	.07 Decimals
	.08 Integers
	.09 Geometry
	.10 Measurement
	.11 Algebraic Concepts
	.12 Graphs, Probability, Statistics
	.13 Problem Solving
	.14 Review

The actual curriculum consists of performance-based objectives which are stated in behavioral terms for students at each grade level. The objectives for a given school year build upon and extend the objectives which were taught during the previous year. In addition, performance objectives that are taught in the latter part of a given school year encompass the skills that have been taught earlier that school year. A typical group of performance-based objectives would read as follows:

Unit 32 — **5.09.04 CIRCLE CONCEPTS** (3 lessons)

PERFORMANCE OBJECTIVES

The student will be able to...

5.09.04.01A identify a radius of a circle;
e.g.,

$\overline{AB}$ and $\overline{AC}$ are radii of the circle. A radius is any line segment from the center to the circle.

5.09.04.02A identify a chord of a circle;
e.g.,

$\overline{UV}$, $\overline{WX}$, and $\overline{YZ}$ are chords because they are line segments whose end points are on the circle.

5.09.04.03A identify a diameter of a circle;
e.g.,

$\overline{BC}$ is a special chord called a diameter of a circle because it passes through the center of the circle. The diameters are the longest chords in a circle; each is twice the length of a radius.

According to data that has been compiled by the Office of Educational Assessment over a period of years, New York City students habitually perform better on the computation subtest of standardized mathematics tests. This was probably due to the fact that teachers concentrated on computation drill and practice and either omitted or spent little time on concept development and problem solving as part of their mathematics instruction. The comprehensive and cyclical nature of the New York City mathematics curriculum discourages this practice. The sequence of instruction for each grade level is designed to expose students to a variety of skills as well as various approaches to the application of those skills throughout the school year. The following is a partial listing of mathematics units which illustrate the New York City approach to sequencing mathematics instruction.

REVISED
INSTRUCTIONAL SEQUENCE - LEVEL 5

TEST NUMBER	UNIT NUMBER	MODULE NUMBER	TITLE	PAGE NUMBER
	1	5.14.01	Review: Problem solving - locating information	1
	2	5.14.02	Review: Place value	3
	3	5.01.01	Round 5- and 6-digit numbers	4
	4	5.14.03	Review: Addition and subtraction	6
	5	5.14.04	Review: Fractions	8
	6	5.06.01	Equivalent fractions	10
	7	5.06.02	Improper fractions and mixed numerals	12
5.01	8	5.06.03	Multiplication with fractions	13
	9	5.10.01	Linear measurement - customary	16
	10	5.07.01	Decimals - thousandths	17
	11	5.07.02	Rounding decimals	18
	12	5.07.03	Addition and subtraction with decimals through thousandths	19
5.02	13	5.10.02	Linear measurement - metric	20
	14	5.14.05	Review: Multiplication	21
	15	5.04.01	Multiplication of 4-digit numbers by 2-digit numbers	22
	16	5.05.01	Division of 4- and 5-digit dividends by 1-digit divisors	24
	17	5.14.06	Review: Division of 2- and 3-digit dividends by 2-digit divisors	26
5.03	18	5.05.02	Division of 4- and 5-digit dividends by 2-digit divisors	27
QUARTERLY TEST #1				
	19	5.12.01	Statistics - mean and median	29
	20	5.12.02	Line graphs	30
	21	5.09.01	Planes	31
	22	5.09.02	Angles	32

Putting together a centrally planned curriculum was relatively easy. Convincing teachers throughout the 32 school districts that they should use it was another matter. Teachers complained that their students were judged on the basis of standardized test scores and that the material on these standardized tests did not reflect large portions of the planned curriculum. The New York City Central Board of Education mathematics curriculum staff shared these concerns with the Office of Educational Assessment, which is in charge of research and test development, and it was decided that a test customized to the New York City curriculum would be provided in the area of mathematics.

In order to provide statistical information on an existing standardized test, New York City students were given a shelf form of the Metropolitan Achievement Test in the Spring of 1986. Again, teachers throughout the school system complained that the test did not reflect the curriculum they were told they must teach in the area of mathematics. Before another test was given the following school year, the Central Board's Mathematics Unit and the Office of Educational Assessment provided the Psychological Corporation with copies of the New York City mathematics curriculum for each grade level. The Psychological Corporation used these curriculum guides to develop approximately 750 new items that measured New York City curriculum objectives which had not been tested by the publisher's version of the Metropolitan Achievement Test.

The test administered during the Spring of 1987 was a different shelf form of the Metropolitan Achievement Test. In addition, the 750 survey items that had been developed by the Psychological Corporation were also tested. These items were not included in student test scores but were used to provide statistical information on each item. Once these tests were administered, the stage was now set for the last phases of the customization process. Several individuals were selected to represent the Mathematics Unit in identifying those shelf test items which did not reflect the New York City mathematics curriculum. These items were not considered for inclusion on the customized test.

During the summer and fall of 1987, staff members from the Mathematics Unit, the Office of Educational Assessment, and the Psychological Corporation met for several lengthy sessions to determine which shelf items and which survey items would be included on tests for each grade level. The task was difficult in that many of the scores on the survey items were very low. This was probably not due to the difficulty level of these items, but rather to the fact that students had never been exposed to the skills that were being tested by these items. A tentative agreement was reached on appropriate items for each grade level. However, the Psychological Corporation staff encountered certain problems concerning the statistical make-up of the tests. The necessary adjustments were then made on an item by item basis over the telephone. After numerous telephone calls, all parties concerned were able to agree on curriculum-appropriate items for each grade level.

In the final phase of the customization process, each group of items was examined for overall content, keeping in mind the areas of skill concentration on a given grade level. Minor adjustments were made where necessary.

In order to begin preparing teachers and students for a customized test, the Office of Educational Assessment and the Mathematics Unit decided to offer staff development sessions in each of the five boroughs of the City of New York (Manhattan, Bronx, Brooklyn, Queens and Staten Island). The first group conferences were held in February and March of 1987. These staff development sessions focused on an item analysis of the skills covered on the test for each grade level, test administration considerations, classroom activities to help prepare students for the test and the interpretation of test results. The participants in these workshops were made aware that the 1988 test would be customized to the New York City mathematics curriculum. Also presented were the implications this customized test would have on mathematics instruction in the classroom. The participants were told that the best way to prepare students for the customized test was for teachers to follow the New York City

mathematics curriculum. Teachers would not be able to concentrate solely on the basic operations of addition, subtraction, multiplication and division and expect their students to perform well on the test.

During January of 1988, staff development sessions were held again throughout the five boroughs. During these sessions, the participants were again made aware that each grade level would have a New York City customized edition of the Metropolitan Achievement Test. They were also given a general breakdown of the skills being tested at each grade level, as well as the number of test items for each skill. This group of sessions emphasized classroom activities to help prepare students for the test and the implications of the test results for classroom instruction. The participants were again reminded that teachers must follow the New York City mathematics curriculum in order to best prepare their students for the customized test.

To summarize, due to the decentralized nature of the New York City school system, many teachers did not adhere to the centralized mathematics curriculum. This presented a problem for students who moved from one area of the city to another during their school years. Once the centralized comprehensive mathematics curriculum was revised and disseminated, teachers still did not see the need to follow the curriculum because their students were judged on the basis of their performance on standardized tests which did not reflect the curriculum. The Office of Educational Assessment decided to provide New York City students with a customized mathematics test that would judge them on the material they had learned and, at the same time, allow them to compare their performance with students from all over the country.